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REPORT ON THE ECHINOIDEA OF THE MURRAY EXPEDITION

PART II

BY

TH. MORTENSEN

WITH ONE PLATE

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THE Irregular Echinoids collected by the Murray Expedition number in all 25 species, namely 15 Clypeastroids and 10 Spatangoids. In comparison with the number of species collected by the "Investigator," 22 Clypeastroids and 31 Spatangoids, this is a somewhat meagre result; the much smaller number of the Spatangoids collected by the Murray Expedition is particularly noteworthy.

Only two of the species are new to science, namely, *Conolampas murrayana* and *Eurypatagus grandiporus*. Of these the former is by far the more interesting, not from a morphological, but from a zoogeographical point of view, the genus *Conolampas* being hitherto known only from the West Indies. Another species of *Conolampas* was, however, taken by the "Albatross" Philippine Expedition, and a third species I took (1922) at the Kei Islands, so that this genus has now been proven to be very well represented in the Indo-Malayan Seas. It is noteworthy, however, that the West Indian species *Conolampas sigsbei* A. Agassiz stands rather apart from the Indo-Malayan species.

Of no small interest is the find of *Clypeaster fervens* Koehler, hitherto known only from a single specimen, the type, collected by the "Investigator." The great number of specimens, between 4000 and 5000, of *Clypeaster annandalei* Koehler taken at St. 194, in the Gulf of Aden, is quite extraordinary, proving that the ground here must be literally covered by this fine Clypeastrid.

LIST OF THE SPECIES COLLECTED.

1. *Echinoneus cyclostomus* Leske . . . . Pemba Strait.
2. *Conolampas murrayana* n. sp. . . . . Maldives.
3. *Clypeaster humilis* (Leske) . . . . Red Sea; S.E. Coast of Arabia.
4. *C. fervens* Koehler . . . . . S.E. Coast of Arabia.
5. *C. reticulatus* (Linnaeus) . . . . . Red Sea; S.E. Coast of Arabia.
6. *C. annandalei* Koehler . . . . . Gulf of Aden; Maldives.
7. *C. eurychorius* H. L. Clark . . . . Pemba Strait.

8. *C. rarispinus* de Meijere . . . . . S.E. Coast of Arabia.
9. *Echinocyamus crispus* Mazzetti . . . . Rea Sea ; S.E. Coast of Arabia ; Strait of Oman.
10. *E. elegans* Mazzetti . . . . . Off Muscat.
11. *Fibularia ovulum* Lamarck . . . . Red Sea.
12. *Laganum depressum* Lesson . . . . Pemba Strait.
13. *L. depressum* var. *delicatum* Mazzetti. . . Red Sea.
14. *L. fudsiyama* var. *indicum* Mrtsn. . . . Pemba Strait.
15. *L. retinens* Koehler . . . . . Off Cape Gardafui.
16. *Linopneustes spectabilis* (de Meijere) . . . Maldives.
17. *Palæotrema ovatum* (Koehler) . . . . Pemba Strait.
18. *Schizaster lacunosus* (Linnaeus) . . . . Maldives.
19. *Pericosmus* sp. . . . . Cape Gardafui.
20. *Maretia planulata* (Lamarck) . . . . Cape Gardafui ; Red Sea.
21. *Eurypatagus grandiporus* n. sp. . . . . Cape Gardafui.
22. *Lovenia elongata* (Gray) . . . . . Red Sea ; Cape Gardafui.
23. *Brissopsis luzonica* (Gray) . . . . . Red Sea ; Pemba Strait ; Addu Atoll.
24. *Metalia robillardi* (de Loriol) . . . . Cape Gardafui.
25. *Metalia sternalis* (Lamarck) . . . . Cape Gardafui.

Family Echinoneidæ.

Echinoneus cyclostomus Leske.

Echinoneus cyclostomus, A. Agassiz, 1872–74, Revision of the Echini, pp. 117, 550, pl. xiv, figs. 6–8, pl. xiv*a*, figs. 5–10.

Echinoneus cyclostomus, de Loriol, 1883, Cat. rais. des Echinod. île Maurice, p. 38, pl. v, figs. 3–6.

Echinoneus cyclostomus Westergren, 1911, Echinoneus and Micropetalon, Mem. Mus. Comp. Zool., vol. xxxix, no. 2.

Echinoneus cyclostomus H. L. Clark, 1917, Hawaiian and other Pacific Echini. Echinoneidæ . . . Spatangidæ, p. 147.

Echinoneus cyclostomus Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 147.

Echinoneus cyclostomus H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 177.

Occurrence :

St. 106, 12.i.1934, Pemba Strait (5° 40′ S., 39° 15′ E.), 212 m. 1 dead test.

This is the greatest depth from which this species has been recorded ; but since it is only a dead test, there is no proof that it actually lived there. The " Siboga " Expedition took a specimen at St. 65, at depths of 120–400 m. ; here again there is no certainty of the depth at which the single specimen was actually taken.

Family Echinolampadidæ.

Conolampas murrayana n. sp. (Pl. I, figs. 1–3.)

Occurrence :

St. 157, 6.iv.1934, off the Maldive Islands (4° 44′ N., 72° 55′ E.), 229 m. 2 specimens.

DESCRIPTIVE NOTES :

	Length.	Breadth.	Height.	Number of pore-pairs. A III. Left.	A III. Right.	A IV (II). Anterior.	A IV (II). Posterior.	A V (I). Anterior.	A V (I). Posterior.
1	67 mm.	62 mm.	34 mm.	46	55	48	61	57	62
2	66 ,,	63 ,,	37 ,,	51	58	55	66	62	60

The shape of the *test* is regularly hemispherical or, in specimen 2, very slightly conical, the apex being in the centre. The oral side is flat, scarcely sunken adorally ; the edge is slightly rounded. The peristome, which is slightly narrower than the periproct, is almost exactly in the centre of the oral side ; the periproct is slightly oblique and a little nearer the posterior edge of the test than in either *Conolampas diomedeæ* Mrtsn. or *Conolampas malayana* Mrtsn., but still distinctly on the oral side. The posterior interambulacrum shows a very slight, hardly distinguishable tumidity before the periproct. The circumference is almost circular.

The *ambulacra* are rather broad aborally, *c.* 8 mm., and continue of the same width to near the edge of the test. The pores are subequal, the outer pore only little larger than the inner ; a shallow furrow, somewhat more distinct in specimen 1 than in specimen 2, connects the pores. The bridge between the consecutive pore-pairs carries a varying number of very small tubercles, not distinctly arranged in a transverse series. The interporiferous area has about 6 primary tubercles in a transverse series ; not rarely there is a primary tubercle on the ridge between the consecutive pore-pairs. The phyllodes are well developed, with three longitudinal series of pores. The bourrelets are fairly prominent.

The tubercles of the *interambulacra* on the aboral side are numerous, small, exactly like those of the interporiferous zones. On the oral side they become more sparse proximally, recalling in this respect *Conolampas sigsbei* A. Agassiz.

The *spines* are as typical of *Echinolampas*, not specifically characteristic. Likewise the *pedicellariæ* are not specifically peculiar. It is noticeable, however, that the tridentate pedicellariæ occur in two forms, one with long and slender, the other with short, somewhat coarser valves.

The *colour* is the usual yellow, the denuded test white.

Remarks.—It might have been expected that this, the only Echinolampadid collected by the "Murray" Expedition, would prove to be identical with one of the two species *sumatrana* and *chuni* collected by the "Valdivia" Expedition in the Indian Ocean. This, however, is not the case. There can be no doubt that the present species must be referred to the genus *Conolampas*, and is very nearly related to the *Conolampas diomedeæ* Mrtsn. collected by the "Albatross" Philippine Expedition. It is clearly distinguished from that species by the somewhat shorter and broader petals, by the more sparse tuberculation proximally on the oral side, and by the periproct being more close to the edge than in that species. The third Indo-Malayan species of *Conolampas*, *C. malayana*, described in Vol. IV, part 1, of my Monograph of the Echinoidea, is easily distinguished from *C. murrayana* mainly by its much shorter petals.

Family CLYPEASTRIDÆ.

Clypeaster humilis (Leske).

Clypeaster humilis, A. Agassiz, 1872–74, Revision of the Echini, pp. 100, 510.

Clypeaster humilis H. L. Clark, 1914, Hawaiian and other Pacific Echini, Clypeasteridæ . . . Scutellidæ, p. 36, pl cxxiii, fig. 23, pls. cxxxvii, cxxxviii, fig. 4.

Clypeaster humilis Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 51, pl. iii, figs. 1–5, pl. xiv, fig. 5.
Clypeaster humilis H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 149.

Occurrence :

St. MB. I(b), 17.ix.1933, Bay between Gt. Hanish and Suyul Hanish Isl., Red Sea, 29 m. 1 specimen.

Ditto (d), 17.ix.1933, same locality, 26 m. 1 young specimen, 46 mm. long.

St. 53, 2.xi.1933, S.E. Coast of Arabia (19° 22′ 36″ N., 57° 53′ E.), 13 m. 5 specimens ; three adults, two young.

These specimens are of the shape that is typical of the Red Sea specimens, with flat oral side.

Clypeaster fervens Koehler.

Clypeaster fervens Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 45, pl. vi, figs. 1, 2, 6, pl. xii, fig. 6, pl. xv, fig. 1.

Occurrence :

St. 45, 29.x.1933, S.E. Coast of Arabia (18° 03′ 30″ N., 57° 02′ 30″ E.), 38 m. 11 specimens, partly broken.

St. 53, 2.xi.1933, S.E. Coast of Arabia (19° 22′ 36″ N., 57° 53′ E.), 13 m. 18 specimens, partly broken.

Some of the specimens from St. 53 are a good deal larger (up to 87 mm. length) than the type, which was 56 mm. long. Otherwise the present specimens are quite in conformity with the type. It is a matter of great satisfaction that sufficient material of this species, hitherto known only from the single specimen taken by the "Investigator" off the S. Coast of Ceylon, has now come to hand. The specimens from St. 45 are much the smallest, ranging from 43 to 20 mm. length.

Clypeaster reticulatus (Linn.).

Clypeaster scutiformis A. Agassiz, 1872–74, Revision of the Echini, pp. 101, 512, pl. xiiif, figs. 1–4.
Clypeaster reticulatus H. L. Clark, 1914, Hawaiian and other Pacific Echini, Clypeastridæ . . . Scutellidæ, p. 34, pl. cxxiv, figs. 3–6.
Raphidoclypus reticulatus Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 68, pl. vi, figs. 3, 4, pl. xv, fig. 10.
Clypeaster reticulatus H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 151.

Occurrence :

St. MB. I(d), 17.ix.1933, Red Sea, Gt. Hanish Bay, 26 m. 3 young specimens.

St. MB. II(a), 28.x.1933, S.E. Coast of Arabia, Khorya Morya Isl. 11 m. 1 young specimen.

St. MB. II(c), 28.x.1933, S.E. Coast of Arabia, Khorya Morya Isl., 29 m. 2 young specimens.

St. 45, 29.x.1933, S.E. Coast of Arabia (18° 03′ 30″ N., 57° 02′ 30″ E.), 38 m. 3 medium sized specimens and one young (14 mm. long) ; besides there are fragments of an old dead test.

In the youngest specimens from St. MB. I(d) and MB. II(c), only 8 mm. long, genital pores are already about to appear, while in the one 14 mm. long from St. 45 they have not yet been formed.

The sculpturing of the test, characteristic of the young examples of this species, is not marked in these specimens, though fairly distinct.

Clypeaster annandalei Koehler.

Clypeaster Annandalei Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 16, pl. i, figs. 1–7, pl. ii, figs. 1–11, pl. iii, figs. 6–9, pl. v, fig. 3, pl. x, fig. 7, pl. xiv, fig. 1.

Occurrence :

St. 35, 16.x.1933, Gulf of Aden (13° 14′ N., 46° 14′ E.), 457–549 m. 8 large specimens.

St. 157, 6.iv.1934, Maldives (4° 44′ N., 72° 55′ E.), 229 m. 4 large specimens (broken).

St. 194, 7.v.1934, Gulf of Aden (13° 16′ N., 46° 20′ E.), 220 m. Very many (*c.* 350) specimens, all of medium size, ranging from *c.* 40 to *c.* 90 mm. length; several of them are more or less broken, and nearly all of them are almost completely bare, rubbed by the contents of the trawl.*

The specimens from Sts. 35 and 157 are up to 110–112 mm. long, thus a little larger than the largest of Koehler's specimens (105 mm.).

Clypeaster eurychorius H. L. Clark.

Clypeaster eurychorius H. L. Clark, 1924, Echinoderms from the S. African Fisheries and Mar. Biological Survey. I. Sea-Urchins (Echinoidea), Fish. and Mar. Biol. Surv. Report, No. 4, p. 10, pl. iii.

Occurrence :

St. 105a, 12.i.1934, Pemba Strait (5° 37′ S., 39° 14′ 36″ E.), 238 m. 1 young and 5 large specimens.

This species was hitherto known only from off the coast of Natal; it is thus of considerable zoogeographical interest that it is now found to occur as far north as the Pemba Strait. The specimens are 130–145 mm. long, thus being considerably larger than the type, which is stated to be 107 mm. long. The single young specimen is only 29 mm. long. It would have been impossible to identify this young specimen as *Cl. eurychorius* if I had not had a series of young specimens, which I collected off Durban in 1929, showing the transitions from the quite young to the adult specimens.

This species is closely related to *Clypeaster annandalei*, which it may recall very much in its general shape. It is, however, easily distinguished from that species, particularly by the much narrower poriferous zones and the correspondingly much broader interporiferous zones.

Clypeaster rarispinus de Meijere.

Clypeaster rarispinus de Meijere, 1904, " Siboga " Echinoidea, p. 134, taf. vi, figs. 55, 56, taf. xviii, figs. 354–361, taf. xix, fig. 362.

Clypeaster Audouini Fourtau, 1904, Contribution à l'étude des Echinides vivant dans le Golfe de Suez, Bull. Inst. Egyptien (4), IV, p. 418, pl. i, figs. 1–3.

* These 350 specimens were only a portion of the total catch of these Echinoids; the total number obtained in the trawl was between 4000 and 5000 (R. B. S. S.).

Clypeaster rarispinus Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 55, pl. v, figs. 1, 2, 7, pl. vi, figs. 7–11, pl. xiv, fig. 9.

Laganum mirabile H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 158, pl. ix, figs. 9, 10.

Clypeaster rarispinus Mortensen, 1940, Echinoderms from the Iranian Gulf, Danish Scientific Investigations in Iran, II, p. 104.

Occurrence :

St. MB. II(a), 28.x.1933, S.E. Coast of Arabia, 11 m. 6 specimens.

St. MB. II(c), 28.x.1933, S.E. Coast of Arabia, 29 m. Many (*c.* 60) specimens, in good condition.

St. 37, 15.x.1933, S.E. Coast of Arabia, 18–22 m. One young specimen, 15 mm. long.

The specimens from St. MB. II(c) are all small, most of them *c.* 25–35 mm. long ; the largest is 43 mm. long ; three specimens are quite small, only 15–18 mm. long. A few of the specimens have been damaged in some way, but have recovered, the wounds closed. One specimen has lost *c.* $\frac{1}{4}$ of the test, but has likewise recovered ; but it has now only four petals ; petal I is lacking, and petal II is rudimentary ; the three other petals are normal. In general the edge is less thickened than normal, but several of the specimens have the edge swollen as typical of the species.

As pointed out in my paper of 1940, there can be no doubt but that Fourtau's *Clypeaster audouini* is identical with *Cl. rarispinus*, and the same applies to Clark's *Laganum mirabile* (as will be shown in my Monograph of the Echinoidea, IV, 2).

Family Fibulariidæ.

Echinocyamus crispus Mazzetti.

Echinocyamus crispus Mazzetti, 1893, Catalogo degli Echinidi del Mar Rosso, Atti Soc. Nat. Modena (3), XII, p. 239.

Echinocyamus crispus de Meijere, 1904, " Siboga " Echinoidea, p. 105, taf. vi, figs. 48–50, taf. xvii, fig. 300.

Echinocyamus crispus Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 137, pl. xii, figs. 16, 17, 21.

Occurrence :

St. 45, 29.x.1933, S.E. Arabia (18° 03′ 30″ N., 57° 02′ 30″ E.), 38 m. Several specimens.

St. 74, 27.xi.1933, Strait of Oman (25° 17′ N., 56° 45′ E.), 155 m. 1 dead test ; 2 young dead tests, the identification of which is not beyond doubt.

St. 10, 17.ix.1933, S. part of Red Sea (13° 31′ N., 42° 31′ E.), 55 m. 1 dead test.

St. MB. II(c), 28.x.1933, S.E. Arabia, 29 m. 3 specimens.

St. MB. I(d), 17.ix.1933, S. part of Red Sea, 26 m. 2 specimens.

Apart from the two small dead tests from St. 74, these specimens are all of the typical form, characterized particularly by the markedly sunken adoral part of the test. The largest specimens are 8 mm. long.

It is a curious fact that Mazzetti does not state the exact locality in which his specimens were taken ; only it is clear that they were taken in the Red Sea. The species is widely distributed in the Indian Ocean and the Malay region.

Echinocyamus elegans Mazzetti.

Echinocyamus elegans Mazzetti, 1893, Catalogo degli Echinidi del Mar Rosso, Atti Soc. Naturalisti di Modena, (3) XII, p. 240.
Echinocyamus elegans H. L. Clark, 1923, The Echinoderm Fauna of S. Africa, Ann. S. Afr. Museum, XIII, p. 393.
Echinocyamus elegans Mortensen, 1940, Echinoderms from the Iranian Gulf, Danish Scientific Investigations in Iran, II, p. 103.

Occurrence :

St. 67, 22.xi.1933, off Muscat (23° 41′ 48″ N., 58° 36′ 00″ E.), 274 m. Several specimens, all dead tests, most of them quite small.

The Danish scientific investigations in Iran collected a good number of specimens, likewise only dead tests, in the Strait of Oman. H. L. Clark records the species from off the Natal coast, but it appears that he was not quite sure of the correctness of the identification. In any case, the species is not known from outside the western part of the Indian Ocean.

Fibularia ovulum Lamarck.

Fibularia ovulum A. Agassiz, 1872–74, Revision of the Echini, p. 507, pl. xiiie, figs. 1–3.
Fibularia craniolaris H. L. Clark, 1914, Hawaiian and other Pacific Echini, Clypeastridæ . . . Scutellidæ, p. 57.
Fibularia craniolaris Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 138, pl. xv, fig. 4.
Fibularia craniolaris H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 163.

Occurrence :

St. MB. I (b), 17.ix.1933, southern part of the Red Sea (13° 39′ 30″ N., 42° 43′ E.), 29 m. 1 small dead test.

St. MB. I(d), 17.ix.1933, same locality, 26 m. 1 live specimen.

I must protest against the specific name *craniolaris* Leske, introduced by Clark, 1914, and since then, unfortunately, in general use. Leske (' Additam. ad I. Th. Kleinii Nat. disp. Echinodermatum,' 1778, p. 214) gave this name to Tab. I, figs. 16–20 of v. Phelsum's " Brief aan Corn. Nozeman over de Gewelw-Slekken of Zee-Egelen " (1774). But this, as well as all the other species of v. Phelsum, is, indeed, quite unrecognizable, and is evidently grossly misdrawn. And since v. Phelsum states that his specimens came from the Adriatic (or from America), where only the flat *Echinocyamus pusillus* occurs, we cannot identify them with the globose Indo-Pacific species. It is also clear that the first two figures of each of v. Phelsum's fourteen " species " resemble the flat *Echinocyamus pusillus* much better than the globose *Fibularia ovulum*. Accordingly I must revive the name *ovulum* of Lamarck, in general use for this very common Indo-Pacific species until Clark took the unfortunate step of using the name *craniolaris* for it.

Family Laganidæ.

Laganum depressum Lesson.

Laganum depressum L. Agassiz, 1841, Monographie des Scutelles, p. 110, pl. 23, figs. 1–7.
Laganum depressum A. Agassiz, 1872–74, Revision of the Echini, pp. 138, 518, pl. xiii, figs. 5–8.
Laganum depressum de Meijere, 1904, " Siboga " Echinoidea, p. 114, taf. vi, fig. 57, taf. xviii, figs. 317, 318
Laganum depressum H. L. Clark, 1914, Hawaiian and other Pacific Echini, Clypeastridæ . . . Scutellidæ, p. 45, pl. cxxiv, figs. 7–12.

Laganum depressum Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 88, pl. ix, figs. 1, 2, 7, 8, pl. xiii, fig. 3, pl. xiv, fig. 2.
Laganum depressum H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum. p. 157.

Occurrence :

St. 106, 12.i.1934, Pemba Strait (5° 39′ S., 39° 16′ E.), 212 m. 1 dead test.

Laganum depressum var. *delicatum* Mazzetti.

Laganum fragile Mazzetti, 1894, Gli Echinidi del Mar Rosso, Mem. Acc. Sci. Modena, (2) X, p. 217.
Laganum delicatum Mazzetti, 1894, Catalogo degli Echinidi del Mar Rosso, Atti Soc. d. Naturalisti di Modena, (3) XII, p. 241.
Laganum mazzettii Thiéry, 1909, Rectifications de nomenclature, Revue critique de Paléozoologie, XIII, p. 137.

Occurrence :

St. MB. I(b), 17.ix.1933, Red Sea (13° 39′ N., 42° 43′ E.), 29 m. 9 specimens.
St. MB. I(d), 17.ix.1933, same locality, 26 m. 15 specimens.

I do not think it justifiable simply to regard the *Laganum delicatum* of Mazzetti as identical with *L. depressum*. It differs from the typical form in being on the whole smaller and thinner, and more or less distinctly concave on the oral side, in the periproct being a little more distant from the posterior edge of the test, and in the oral ambulacral furrows being somewhat shorter. Also it appears to mature earlier than the typical *depressum* ; the genital pores are developed already at a size of 9–10 mm. length of test, while in the typical form I have not found them developed earlier than at a size of 12–15 mm. length of test.

Finding that Dames, in his ' Echiniden d. vicentinischen u. veronesischen Tertiärablagerungen ' (1877), had already described a *Laganum fragile*, Mazzetti changed his name *fragile* into *delicatum* (*op. cit.*, 1894). Not knowing this, Thiéry again, in 1909, proposed a new name, *mazzettii*, for the same species. This latter name, of course, becomes a simple synonym of *L. delicatum*.

Laganum fudsiyama var. *indicum* Mrtsn.

Occurrence :

St. 106, 12.i.1934, Pemba Strait (5° 39′ S., 39° 16′ E.), 212 m. 2 small dead tests.

I think it almost certain that these two small specimens belong to the var. *indicum* of *Laganum fudsiyama* Döderlein ; but since one of the main characters of it, the naked periproct (most other *Laganum* species have spines on the periproctal plates), cannot be observed, the periproctal plates having been lost, full certainty cannot be reached.

This variety *indicum* will be described and figured in Vol. IV, 2, of my Monograph of the Echinoidea from adult, well preserved specimens which I collected at Mauritius in 1929.

Laganum retinens Koehler.

Laganum retinens Koehler, 1922, Echinoderma of the Indian Museum, Echinoidea. II. Clypeastridés et Cassidulidés, p. 99, pl. x, figs. 5, 6, 8, 9, 13, pl. xv, fig. 7.

Occurrence :

St. 24, 9.x.1933, near Cape Gardafui (11° 54′ N.. 51° 13′ E.), 73–220 m. 1 specimen.

This is a perfectly typical adult specimen of this characteristic species, hitherto known only from the Andamans. It affords the important information (omitted by Koehler) that the periproct is entirely naked, a character otherwise found only in *Lagenum fudsiyama*, from which species it differs, however, very markedly by its much larger and almost lyre-shaped petals.

Family Scutellidæ.

Echinodiscus auritus Leske.

Echinodiscus auritus A. Agassiz, 1874, Revision of the Echini, p. 531, pl. xiiic, figs. 1–3.
Echinodiscus auritus H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the Brit. Museum, p. 169.

Occurrence :

St. 80, 30.xi.1933, S.E. corner of Arabia (22° 14′ N., 59° 49′ E.), 16–22 m. 3 specimens and fragment of a fourth.

Family Palæopneustidæ.

Linopneustes spectabilis (de Meijere).

Palæopneustes spectabilis de Meijere, 1904, " Siboga " Echinoidea, p. 172, taf. viii, figs. 86–90, taf. xxi, figs. 422–426.
Linopneustes spectabilis Koehler, 1914, Echinoderma of the Indian Museum, Echinoidea. I. Spatangidés, p. 62, pl. v, figs. 3, 6, pl. xi, figs. 7, 8, pl. xvii, figs. 36–51.
Palæopneustes spectabilis H. L. Clark, 1917, Hawaiian and other Pacific Echini, Echinoneidæ . . . Spatangidæ, p. 145.

Occurrence :

St. 143, 30.iii.1934, Maldives (5° 15′ 48″ N., 73° 22′ 48″ E.), 797 m. 11 large specimens and some fragments.

These specimens, some of which are in excellent condition, are all of nearly the same size, *c.* 150 mm. long, *c.* 130–135 mm. broad, *c.* 55–60 mm. high. The shape varies to some degree, from evenly arched aborally to rather distinctly sub-conical ; the oral side flat or somewhat concave.

On comparing these specimens with the one figured in Pl. VIII, fig. 87 of the " Siboga " Echinoidea one is struck by the different size of the petals. In the figure cited the petals do not reach more than about $\frac{2}{3}$ the distance from the apex to the edge of the test ; the same is the case in a co-type of the species, which I have received from the late Prof. Max Weber. In the present specimens the petals are much longer, *c.* $\frac{5}{6}$ of the distance from the apex to the edge of the test. This would seem to justify our regarding the specimens from the Indian Ocean as specifically distinct from those from the Malay Archipelago, the typical *spectabilis*. Also the notch in the anterior edge of the test is deeper in the specimens from the Indian Ocean than in the specimen figured in Pl. VIII, fig. 86 of the " Siboga " Echinoidea and in the co-type of *spectabilis* at hand. Judging from this one could hardly avoid regarding the specimens from the Indian Ocean as a distinct species, not as identical with *spectabilis*. But in two large specimens from the Philippines, " Albatross " St. 5528, the petals are as long and the anterior notch as deep as in the specimens from the Indian Ocean. Thus the differences in these two characters are not reliable. The pedicellariæ also are alike in both, as already emphasized by Koehler (*op. cit.*). Accordingly, it seems beyond doubt that the specimens from the Indian Ocean are really the same species as the typical *spectabilis* from the Malay region.

It is very noteworthy that the coarse form of tridentate pedicellariæ, described and

figured by Koehler (*op. cit.*, Pl. XVII, figs. 42, 45, 46, 49) appears to be lacking completely in the present specimens, but since Koehler found them richly developed in the fragmentary specimens taken by the " Investigator " off the Laccadive Islands, it is evident that this is only a case of individual variation, not a specific difference.

Palæotrema ovatum (Koehler).

Palæotropus ovatus Koehler, 1914, Echinoderma of the Indian Museum, Echinoidea. I. Spatangidés, p. 39, pl. iii, figs. 3–5, 11, 12, pl. xvii, figs. 32–35.

Occurrence :

St. 113, 15.i.1934, Pemba Strait (5° 05′ S., 39° 14′ E.), 220 m. 1 young specimen, only 8.5 mm. long, somewhat broken.

This specimen shows the important feature that the ambulacra are biserial throughout to the apical system. Thus this species must be transferred to the genus *Palæotrema*, established by Koehler (*op. cit.*, p. 45) for the species *P. loveni* A. Agassiz, characterized by the character of the ambulacra continuing biserially throughout to the apical system, in contradistinction to *Palæotropus*, in which the ambulacra are monoserial adapically. H. L. Clark, it is true, maintains this difference to be only stages of growth, and therefore makes *Palæotrema* (as well as *Palæobrissus*) synonymous with *Palæotropus* ; but he is very much in error herein, as will be documented in Vol. V of my Monograph of the Echinoidea.

Genital pores have already appeared in this young specimen ; there are three genital pores, the anterior being to the right, viz. in the madreporite, as in *P. loveni*.

The specific validity of *P. ovatum* is somewhat problematic. The only characters giving a real distinction from *loveni* are the shape of the labrum, which is more square in *ovatum* than in *loveni*, and the posterior end of the test, which is subvertical, and the periproct not distinct from above, in *ovatum*, but decidedly oblique and the periproct distinct from above in *loveni* ; but these differences may perhaps be due only to the difference in age, only young specimens of *ovatum* and only adult specimens of *loveni* being known. Not till specimens of comparable size of the two, and especially adult specimens of *ovatum*, become known, can it be decided definitely whether *ovatum* is a distinct species or is perhaps identical with *loveni*.

Family Hemiasteridæ.

Schizaster lacunosus (Linnaeus).

Echinus lacunosus Linnæus, 1758, Systema naturæ, Ed. X, p. 665.
Schizaster japonicus A. Agassiz, 1881, " Challenger " Ech., p. 202, pl. xxxvi, figs. 8–13.
Schizaster lacunosus Lovén, 1887, On the species of Echinoidea described by Linnaeus, Bihang K. Svenska Vet. Akad. Handl., 13, IV, 5, p. 168.
Schizaster lacunosus Mortensen, 1907, " Ingolf " Ech. II, p. 120.
Schizaster lacunosus H. L. Clark, 1917, Hawaiian and other Pacific Echini, Echinoneidæ . . . Spatangidæ, p. 193.
Schizaster lacunosus H. L. Clark, 1924, Echinoderms from the S. African Fisheries Survey. 1. Sea-Urchins (Echinoidea), Fish. and Mar. Biol. Surv. Report, No. 4, p. 12.
Schizaster lacunosus H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 210.

Occurrence :

St. 137, 23.iii.1934, Addu Atoll, Maldives (0° 36′ S., 73° 13′ E.), 46 m. 3 small specimens, 25 mm. long, one of them a naked test.

St. 142B, 30.iii.1934, Fadifollu Atoll, Maldives (5° 23′ S., 73° 37′ E.), 37 m. (Petersen grab). 1 large specimen in very fine condition. It measures 65 mm. length, 57 mm. width, 41 mm. height.

These specimens are all of them whitish, the part within the peripetalous fasciole a very light brownish, and the peripetalous fasciole a little darker, thus being quite conspicuous. The specimens of 25 mm. length have the genital pores fully developed. While in the young specimens the latero-anal fasciole remains very conspicuous throughout to where it joins the peripetalous fasciole, in the large specimen it becomes gradually very thin and inconspicuous aborally, covered by the surrounding spines, but it does not disappear, and can be traced throughout to where it joins the peripetalous fasciole.

The species has been recorded from the Andamans by H. L. Clark (1925), and by the same author (1924) from the Natal coast; it may thus be expected to be widely distributed in the Indian Ocean. One can therefore only wonder that it has not otherwise been recorded from the Indian Ocean; particularly it is curious that it was not taken by the "Investigator"—unless perhaps it should ultimately be found that the two young specimens, 10 and 11 mm. long, described by Koehler (1914) under the name of *Brisaster indicus* (Echinoderma of the Indian Museum, VIII, Echinoidea, I, p. 201), are really the young of *Schizaster lacunosus*. I do not think this at all probable; but the fact that genital pores are not yet developed and pedicellariæ not found (the structure of the globiferous pedicellariæ gives a very clear distinction between *Schizaster* and *Brisaster*) makes the determination of these young specimens somewhat uncertain, although the shape of the test, as figured by Koehler (*op. cit.*, Pl. X, figs. 9–13), does recall *Brisaster*.

Pericosmus sp.

Occurrence:

St. 27, 12.x.1933, 11° 57′ N., 50° 35′ E., 37–91 m. 1 specimen.

This very beautifully preserved specimen is a young one, being only 21 mm. long, 19 mm. broad, 17 mm. high. Genital pores not yet developed. It is of a uniform purplish colour, the peripetalous fasciole slightly darker and thus quite conspicuous.

I do not think it possible to reach any definite conclusion as to the question to which of the known recent species of *Pericosmus* this specimen should be referred, or whether it perhaps represents a species hitherto undescribed. The globiferous pedicellariæ, so important for the distinction of the recent species of this genus, might probably have led to a definite indication as to the species to which it belongs; but, unfortunately, these pedicellariæ are totally lacking, as is also the coarse form of the tridentate pedicellariæ. The slender form of the tridentate pedicellariæ, the rostrate and ophicephalous pedicellariæ are present, but they are of so uniform a character in this genus that they cannot give any clue to the question to which species this specimen should be referred. The rather high shape of the test seems to preclude the idea that it might be a young *P. macronesius*, and its high and straight, not concave posterior end distinguishes it clearly from the other species known from Mauritius, as also from the Red Sea species *akabanus*, to which species it has otherwise a good deal of resemblance. Not till adult specimens come to hand will it be possible to solve the problem to which species this specimen belongs.

It should be pointed out that the peripetalous fasciole bends deeply inwards between the petals as also in the posterior interambulacrum; anteriorly it is double, at least on

the right side, where it crosses the frontal ambulacrum. The frontal tube-feet have no sucking disk, such as is characteristic of the species *melanostomus* Mrtsn. and *keiensis* Mrtsn. (These two species will be described in Vol. V of the Monograph of the Echinoidea.)

Family Spatangidæ.

Maretia planulata (Lamarck).

Maretia planulata A. Agassiz, 1872–74, Revision of the Echini, pp. 140, 570, pl. xixb, figs. 7–12.
Maretia planulata de Meijere, 1904, " Siboga " Echinoidea, p. 190, taf. xxiii, figs. 478, 479.
Maretia planulata Koehler, 1914, Echinoderma of the Indian Museum, Echinoidea. I. Spatangidés, p. 106, pl. xi, figs. 18, 19, pl. xx, figs. 8–13.
Maretia ovata H. L. Clark, 1917, Hawaiian and other Pacific Echini, Echinoneidæ . . . Spatangidæ, p. 248.
Maretia ovata H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 226.

Occurrence :

St. 27, 12.x.1933, near Cape Gardafui (11° 57′ N., 50° 35′ E.), 37–91 m. 4 specimens.

St. MB. I(d), 17.ix.1933, Red Sea, bay between Gt. Hanish and Suyul Hanish Isl., 26 m. 1 specimen.

These specimens are all of them very light coloured, particularly the largest specimen from St. 27 (42 mm. long), which is quite white, even the long spines of the aboral side being quite clear, unbanded. Otherwise they are typical *M. planulata*.

As explained in my Report on the Echinoidea of the " Albatross " Philippine Expedition, III, I must protest against H. L. Clark's changing of the universally known specific name *planulata* (Lamarck) into *ovata* (Leske), a change for which there is no foundation at all, Leske's *Spatangus ovatus* being clearly no *Maretia* at all, whatever it may be (? *Echinocardium flavescens*).

This species was not hitherto found in the Red Sea. The locality where it was taken by the " Mabahiss " being in the southern end of the Red Sea, it may be suggested that the species does not go much further north there, since it has not been found elsewhere in the Red Sea.

Eurypatagus grandiporus n. sp. (Pl. I, figs. 4–5.)

Occurrence :

St. 177, 2.v.1934, near Cape Gardafui (12° 02′ N., 50° 39′ E.), 274–366 m. Several specimens.

In its general appearance this species very much resembles the species from the Philippines, *E. ovalis*, the genotype of the genus *Eurypatagus*,* particularly when covered with the spines, the colour being also the same in both, a dark red, some of the spines being light yellowish, which gives a variegated appearance. The denuded test, however, differs in various features from that of *ovalis*. The outline of the test is different, less slender than in *ovalis*, and the test is higher, the posterior interambulacrum being more or less conspicuously raised ; but particularly the petals are different, broader than in *ovalis*, and the pores are much larger than those of *ovalis*, which especially makes the general appearance of the present species conspicuously different from that of *ovalis*.

In the pedicellariæ there is no appreciable difference between the two species.

A more detailed description of this species, as well as of the genotype *E. ovalis*, will be given in Vol. V of my Monograph of the Echinoidea.

* *Cf.* the author's forthcoming Report on the Echinoidea of the " Albatross " Philippine Expedition, III.

Lovenia elongata (Gray).

Lovenia elongata A. Agassiz, 1872–74, Revision of the Echini, p. 575, pl. xixc, figs. 1–4.
Lovenia elongata Döderlein, 1906, Die Echinoiden d. deutschen Tiefsee Exped., p. 265, taf. xlviii, fig. 5.
Lovenia elongata Koehler, 1914, Echinoderma of the Indian Museum, Echinoidea. I. Spatangidés p. 111, pl. xi, figs. 5, 6, pl. xii, fig. 10, pl. xiii, fig. 8, pl. xix, figs. 25–32.
Lovenia elongata H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 230.

Occurrence :

St. MB. I (d), 17.ix.1933, Red Sea, bay between Gt. Hanish and Suyul Hanish Isl., 26 m. 1 young specimen.

St. 27, 12.x.1933, near Cape Gardafui (11° 57′ N., 50°35′ E.), 37–91 m. Several specimens.

These specimens are all of them rather young, their length varying from 23–38 mm. Most of them are in fairly good condition, and have preserved their natural reddish colour on the aboral side. The subanal fasciole is very conspicuous on account of its dark colour.

Brissopsis luzonica (Gray).

Kleinia luzonica Gray, 1855, Catalogue of the Recent Echinida of the British Museum, p. 49.
Brissopsis luzonica A. Agassiz, 1872–74, Revision of the Echini, p. 593.
Brissopsis luzonica Koehler, 1914, Echinoderma of the Indian Museum, Echinoidea. I. Spatangidés, p. 207, pl. xiii, fig. 16, pl. xiv, figs. 4, 5, 7, 12, 13, pl. xx, figs. 51–54.
Brissopsis luzonica H. L. Clark, 1917, Hawaiian and other Pacific Echini, Echinoneidæ . . . Spatangidæ, p. 204, pl. clii, figs. 5–8, pl. clv, figs. 2, 3.
Brissopsis luzonica H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 213.

Occurrence :

St. A, 6.ix.1933, Red Sea (29° 17′ N., 32° 43′ E.), 65–68 m. 4 specimens, the largest 65 mm. long, complete, the others badly broken.

St. 113, 15.i.1934, Pemba Strait (5° 05′ 17″ S., 39° 13′ 39″ E.), 220 m. 1 young specimen, badly broken.

St. 137, 23.iii.1934, Addu Atoll (0° 36′ S., 73° 12′ 48″ E.), 46 m. 10 specimens, more or less broken, but otherwise in very fine condition.

The specimens from St. 137 were taken in a haul with the " Petersen " grab, on a bottom of very fine coral mud ; this proves that this species occurs in great numbers on such bottom, in relatively shallow water, as I also found to be the case at Ghardaqa, on the Egyptian Red Sea coast. The fact that at St. 113 only one specimen was taken, likewise with the " Petersen " grab, may be due to the bottom there being less suitable for the species, or that the great depth is less favourable to it. The specimen is badly broken, but I have no doubt about the identification.

The specimen of 65 mm. length is the largest specimen of this species known with certainty.

Metalia robillardi (de Loriol).

Brissus robillardi de Loriol, 1876, Note s. qu. espèces nouvelles appart. à la classe des Echinodermes. Mém. Soc. de Phys. and d'Hist. Nat. de Genève, XXIV, p. 9, pl. ii, figs. 1–1c.

Occurrence :

St. 27, 12.x.1933, near Cape Gardafui (11° 57′ N., 50° 35′ E.), 37–91 m. 1 specimen.

The single specimen, which is in fine condition, measures 70 mm. length, 63 mm. width, 45 mm. height at anterior, 26 mm. at the posterior end. The apical system is 16 mm. from the anterior, 54 mm. from the posterior end.

In his "Catalogue raisonné des Echinodermes rec. par M. V. de Robillard à l'île Maurice" ('Mém. Soc. d'Hist. Nat. Genève,' XXVIII, 8, 1883, p. 45) de Loriol declared the *Brissus robillardi*, described by him in 1876, to be a synonym of *Metalia sternalis*, claiming to have a series of transitions from such as have a uniformly convex aboral side with the apical system 37% of the total length from the posterior end to such as have the anterior end very high and the apical system close to the anterior end. At about the same time Pomel, in his 'Classification méthodique,' 1883, p. 34, makes *robillardi* the type of a new genus, *Prometalia*, this genus being accepted by Lambert and Thiéry in their 'Essai de nomenclature raisonnée.' This is not the place to discuss the value of *Prometalia* as distinct from *Metalia*; that will be done in my Monograph of the Echinoidea, V. It may suffice here to say that I cannot accept this view, any more than I can accept *Brissoma* and *Kleinia* as distinct from *Brissopsis*, these genera being based almost exclusively on the character of the posterior petals, whether divergent or confluent.

The fact that de Loriol thought *Metalia robillardi* to be only an extreme variant of *M. sternalis* might indicate that he has seen specimens intermediate in the character of the posterior petals. This is, however, evidently not the case, since he says about *sternalis* (*op. cit.*, 1883, p. 46): "Les ambulacres postérieurs sont toujours fortement arqués, cependant ils le sont peu dans le *Metalia robillardi*, qui est une exception." It is curious that de Loriol did not attach more importance to this important difference in the character of the posterior petals; but there can be no doubt but that this difference in the petals, together with the characteristic difference in the tridentate pedicellariæ, mark *M. robillardi* as a distinct species.

Metalia sternalis (Lamarck).

Metalia sternalis A. Agassiz, 1874, Revision of the Echini, p. 600, pl. xxia, figs. 4, 5, pl. xxic, figs. 5–9.
Metalia sternalis H. L. Clark, 1917, Hawaiian and other Pacific Echini, Echinoneidæ . . . Spatangidæ, p. 209, pl. cxlvi, fig. 30.
Metalia sternalis H. L. Clark, 1925, Catalogue of the Recent Sea-Urchins in the British Museum, p. 216.

Occurrence:

St. 27, 12.x.1933, near Cape Gardafui (11° 57′ N., 50° 35′ E.), 37–91 m.

Two specimens, respectively 80 and 115 mm. long; the larger specimen badly broken, but the fragments could be glued together so as to form a fairly complete specimen. The larger specimen has 10, the smaller 9 tube-feet to each side within the subanal plastron.

Zoogeographical Remarks.

From a zoogeographical point of view the facts of outstanding interest in the Echinoids collected by the Murray Expedition are the discoveries of a species of *Goniocidaris*, two species of the subfamily *Cidarina* and a species of *Conolampas* in the Indian Ocean.

The genus *Goniocidaris*, so richly developed in the eastern seas, from Japan to Australia and New Zealand, was not hitherto known to occur in the Indian Ocean, whereas a species is known to occur in S. Africa (*cf.* 'Monograph of the Echinoidea,' I, p. 154, note 2). The discovery by the Murray Expedition of the species *Goniocidaris indica* Mrtsn. (described in Part I of this report) is thus of very considerable interest. More surprising, indeed quite unexpected, was the discovery of a true *Cidaris* species, *Cidaris Mabahissæ* Mrtsn., and a close relative, *Lissocidaris fusca* Mrtsn. (both of them described in Part I of this report), both belonging to the subfamily *Cidarina*, otherwise known only from the Atlantic,

and previously thought to be peculiar to the Atlantic region (*cf.* my 'Monograph of the Echinoidea,' I, p. 536). The zoogeographical relation between these two Cidarids of the Indian Ocean and the main, Atlantic group of the *Cidarina* is not easily explained. No form of this group is known to occur in South African waters, so that there is, so far as our present knowledge goes, no direct connection between these two groups. Recurrence to the old Tethys Sea would not seem to help us; were the *Cidarina* group represented already in the Tethys Sea, one would expect it to have a much wider distribution also in the Indo-Pacific, like, *e.g.* the genus *Diadema*. We have here a case parallel to that of the genus *Pseudoboletia*, having its main distribution in the Indo-West Pacific, with two stray representatives in the Atlantic. In this case the Tethys Sea seems to afford a natural explanation of the recent distribution; but in the case of the *Cidarina* it does not seem that the Tethys Sea can afford a natural explanation of their geographical distribution.

With respect to the genus *Conolampas* it would seem that the Tethys Sea affords a very obvious explanation of the recent distribution of the genus. By the researches of the "Murray" and the "Albatross" expeditions and my own researches at the Kei Islands it has been proved that the genus has its main distribution in the Indo-West Pacific, being represented there by three distinct species. The single species, *Conolampas sigsbei*, now living in the West Indian region, is very probably the only Atlantic survival of a genus formerly distributed all over the Tethys Sea. The fact that the West Indian species stands rather apart from the three Indo-Pacific species is in good accordance with this explanation of the recent geographical distribution of the genus, this species having for so long a time been isolated from the other members of the genus.

The researches of the "Murray" Expedition have brought evidence that the Pemba Strait and the sea around Cape Gardafui are remarkably rich in Echinoids. Another Echinoid centre is, as shown by the researches of the "Investigator" together with those of the "Murray" Expedition, the Maldives; further, the old researches of Robillard, together with my own researches in 1929, have shown Mauritius to be a great centre of Echinoids (and other Echinoderms). On the other hand, there is, for the present at least, no proof that the waters round the Seychelles are particularly rich.

Most of the species found in these localities will be sure to be widely distributed over the whole of the Indo-West Pacific, even though hitherto known only from one of these localities. A striking example of this is afforded by *Micropyga violacea*, known only from the Pemba Strait and the Malay Archipelago. There are, however, a number of species known only from the East African Coast, and not taken merely once. Such species are:

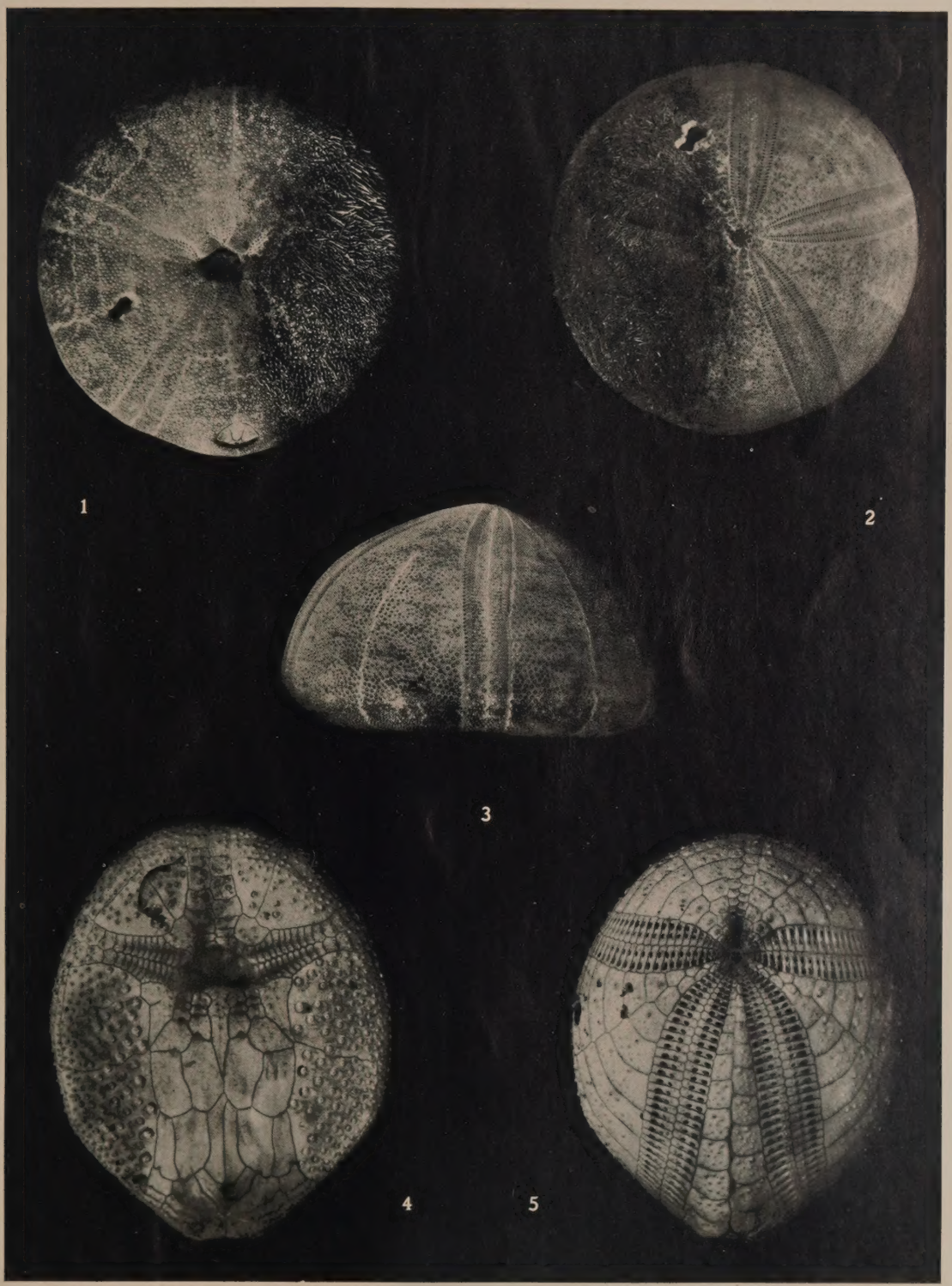
Arœosoma alternatum Mortensen.
Chætodiadema africanum H. L. Clark.
Salmacis erythracis H. L. Clark.
Clypeaster eurychorius H. L. Clark.
Echinocyamus elegans Mazzetti.
Laganum depressum delicatum Mazzetti.

These species would seem to indicate that the Western part of the Indian Ocean forms a separate zoogeographical subregion, though not very definitely limited. Mauritius and the Maldives forming a connecting link with the main Indo-West Pacific region. Much more extensive researches are needed to get this problem settled; but the facts at present available do indicate the existence of a separate subregion in the East African seas.

EXPLANATION OF PLATE I.

FIGS. 1–3.—*Conolampas murrayana* Mrtsn., oral (1), aboral (2), and side view (3).
FIGS. 4, 5.—*Eurypatagus grandiporus* Mrtsn., oral (4) and aboral sides (5).

All natural size.



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